SECTION 1001
LANDSCAPE IRRIGATION SYSTEM

1001.1 GENERAL:

The work consists of installing a complete underground sprinkler system as shown on the drawings and as specified hereafter. The CONTRACTOR performing this work shall furnish all labor, equipment, materials, and permits necessary for the completion of the system, except those specified to be furnished by others. Unless otherwise specified or indicated on the drawings, or authorized by the ENGINEER. The construction of the sprinkler system shall include the furnishing, installing, and testing of all pipe, fittings, valves, heads, controllers, wires, air release and vacuum valves, backflow preventers inlet and discharge piping, automatic drain valves, manual drain valves, valve boxes, and all other components pertinent to the drawings and specifications of this system. The CONTRACTOR shall perform all trenching, excavating, boring, backfilling, compacting, concrete pouring, electrical work, welding, and any other work necessary for the completion of the project.

1001.2 REFERENCES:

1001.2.1 American Society for Testing and Materials (Latest Editions)(ASTM)

D-1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D-1785 Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80 and 120.

D-1875 Test Method for Density of Adhesives in Fluid Form

D-2241 Specifications for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe

D-2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D-2467 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, schedule 80.

D-2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D-2774 Recommended Practices for Underground Installation of Thermoplastic Pressure Piping

D-2855 Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride)(PVC) Pipe and Fittings.

D-3139 Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

1001.2.2 This Publication:

Section 1502 - Submittals

1001.3 MATERIALS

1001.3.1 GENERAL:

1001.3.1.1 All materials shall be new and without flaws or defects of any type and shall be the best of their class and kind. All materials shall have a minimum guarantee of one year against material defects or defective workmanship.

1001.3.1.2 All materials shall be of the brands and types noted on the plans or as specified herein, or approved as equal by the ENGINEER in accordance with Section 6.

1001.3.1.3 For reasons of equipment compatibility, all sprinkler heads, automatic valves and the sprinkler control system shall be of the same manufacturer, unless otherwise noted and approved by the ENGINEER.

1001.3.1.4 The irrigation system was designed around equipment manufactured by specific companies as a standard. Approved as equal equipment by other manufacturers may be used only with the approval of the ENGINEER and the OWNER five days prior to the opening of bids.

1001.3.2 PLASTIC PIPE AND FITTINGS

1001.3.2.1 PLASTIC PIPE:

1001.3.2.1.1 All mainline plastic pipe which is 2" or smaller, shall be Schedule 40 PVC and shall conform to ASTM D 1785. All mainline pipe which is larger than 2" diameter shall be PVC 1120 or 1220 (SDR-PR) pipe, SDR-21 with a 200 psi pressure rating and conforming to ASTM D 2241, with flexible joints conforming to ASTM D 3139. All lateral lines plastic pipe shall be schedule 40 PVC and shall conform to ASTM D 1785.

1001.3.2.1.2 PVC pipe shall be continuously marked with identification of the manufacture, type, class, size and material and shall conform to ASTM D 1784. Solvent joints shall meet ASTM D 2774 and D 2855 requirements. Pipe shall be produced in 20 foot lengths. All plastic pipe shall be continuously and permanently marked with the following information: manufacturer's name, nominal pipe size, schedule, kind of material, kind of pipe, and the pressure rating in psi in accordance with the standards of the National Sanitation Foundation. Pipe shall be free of holes, foreign material, blisters, wrinkles, dents, or sun scald.

1001.3.2.2 PVC Fittings: Fittings on PVC mainlines larger than 2" shall be ring and gasket fittings. Fittings on PVC mainlines 2' in diameter and smaller and on all PVC laterals, shall be Schedule 40 PVC, Type 1, Cell Classification 12454-B, and shall comply with ASTM D 2466, D 2467, and D 1784.

1001.3.2.3 Risers and Threaded Nipples: All threaded PVC nipples and risers shall be Schedule 80 PVC pipe. All galvanized nipples and risers shall be Schedule 40 galvanized steel pipe.

1001.3.3 VALVES AND VALVE BOXES:

1001.3.3.1 Valves: Valves for use in electrically controlled automatic control systems shall be diaphragm activated and hydraulically operated solenoid valves as specified on the plans.

1001.3.3.2 Valve Boxes: Valve boxes shall be as specified on the plans.

1001.3.4 SPRINKLER HEAD AND BUBBLERS: Sprinkler heads and bubblers shall be as specified on the plans and shall be installed on schedule 80 PVC threaded risers.

1001.3.5 CONTROLLERS: Controllers shall be as specified on the plans.

1001.3.6 BACKFLOW PREVENTER: The backflow prevention device shall be as specified on the plans.

1001.3.7 CEMENTS, CLEANERS/PRIMERS AND JOINT COMPOUNDS:

1001.3.7.1 Cement shall be No. 2200 series Uni-Weld or Rectorseal Gold low temperature plastic pipe cement or approved equal for use on all sizes and schedules of PVC pipe and fittings. Cement must be NSF approved and meet ASTM D 2564 specifications.

1001.3.7.2 Cleaner/primer shall be No. 8700 United Elchem hi-etch cleaner/primer or approved equal. Cleaner/primer must be any color other than clear.

1001.3.7.3 All threaded connections between PVC and metal pipe shall be made using Rectorseal No. 100 virgin heavy duty sealing past of plasto-joint stick as manufactured by Lake Chemical company or teflon tape.

1001.3.7.4 All metal to metal connections shall be made using Rectorseal No. 5, slow dry, soft set pipe thread compound or approved equal. All PVC to PVC threaded connections shall use teflon tape.

1001.3.7.5 "O"-ring gasket and pipe spigot ends shall be lubricated using the lubricant recommended or supplied by the pipe manufacturer. If the pipe manufacturer does not provide a lubricant for the pipe, use IPS Weld-On No. 787 gasket lube as manufactured by Industrial Polychemical Service or approved equal.

1001.3.8 WIRE(120 VOLTS): Wire for the 120 volt wiring shall be solid copper (or stranded copper in larger wire sizes) underground feeder for direct burial and PVC insulated. Size of wire shall be No. 12 AWG.

1001.3.9 WIRE(24 volts): Wire for the 24 volt wiring shall be solid copper wire, PVC insulated, UL approved underground feeder wire for direct burial in ground. Common wires shall be No. 12, white, except as noted on drawings. The wire shall be supplied in either 500 feet or 2,500 feet rolls.

1001.3.10 WIRE SPLICING MATERIALS: All wire splices shall be made watertight using 3M Scotchlok wire connectors or approved equal. All wiring installed under sidewalks, roadways, parking lots, etc., shall be installed in a 1 1/4 inch or larger Class 200 PVC sleeve.

1001.3.11 OTHER MISCELLANEOUS FITTINGS AND MATERIALS: All other miscellaneous fittings and materials shall be as specified on the plans.

1001.4 SUBMITTALS AND RECORD DRAWINGS

1001.4.1 SUBMITTALS: The CONTRACTOR shall submit all material and/or information as specified in Section 1502 of the Supplemental Technical Specification or as required by the ENGINEER in accordance with Section 6 of these specifications.

1001.4.2 RECORD DRAWINGS:

1001.4.2.1 The CONTRACTOR in conjunction with the ENGINEER, shall provide and keep up to date a complete set of "as-built" drawings which shall be corrected daily to show all changes in the location of sprinkler heads, controllers, backflow preventers, valves, drains, meters, points of connection, wire splice points, pipe and wire routing and other changes that may have been made from the original drawings and specifications as provided to him. All gate valves, manual drains, wire splices, automatic and manual valve locations, controllers, power supply, and mainline piping shall be shown with actual measurements to reference points so they may be easily located in the field.

1002.4.2.2 At the time of final acceptance the CONTRACTOR shall furnish to the OWNER a reproducible "as-built" record drawing(s) prepared by a qualified drafts-person showing the entire completed irrigation system. The CONTRACTOR shall also provide and install in each of the controller vaults on the project a legible reduction, laminated in plastic, layout drawing of the irrigation system that the controller operates.

1001.5 PREPARATION AND INSTALLATION FOR IRRIGATION SYSTEM:

1001.5.1 GENERAL:

1001.5.1.1 All materials and equipment shall be installed in a neat and workmanlike manner according to manufacturer's published recommendations and specifications, local, and state codes, as shown on the detail drawings, plans and as specified herein.

1001.5.2 PRODUCT HANDLING: The CONTRACTOR shall be responsible for correct procedures in loading, unloading, staking,

transporting, and handling all materials to be used in the system. The CONTRACTOR shall avoid rough handling which could affect the useful life of equipment. Pipe shall be handled in accordance with the manufacturer's published recommendations on loading, unloading, and storage.

1001.5.3. EXCAVATION AND TRENCHING:

1001.5.3.1 The CONTRACTOR shall stake out the location of each run of pipe and all sprinkler heads and valves prior to trenching. Each run of the system shall be approved by the ENGINEER before actual installation is started. Prior to trenching the Contractor shall contact the New Mexico One Call, 260-1990, two (2) working days in advance of any excavation.

1001.5.3.2 Excavation and trenching for pipe lines shall be true to line. The width of the trenches shall not be greater than necessary to permit proper jointing, tamping, backfilling, bedding or any other installation procedures that may be necessary. Trench widths shall also be wide enough so that there will be a minimum horizontal separation of 4 (four) inches between pipes in the same trench.

1001.5.3.3 In areas where trees are present, trench lines will be adjusted on the site to install trenches beyond the drip line of the tree.

1001.5.3.4 Trench depths shall be sufficient to provide the specified pipe cover as described in these specifications or as noted on the plans. In rocky areas the trenching depth shall be 6 (six) inches below normal trench depth to allow for pipe bedding as described in these specifications.

1001.5.4 DEPTH OF BURY: There shall be a minimum of 28" and a maximum of 30" of cover for all constant pressure mainline. There shall be a minimum of 18" and a maximum of 20" of cover for all mainline located downstream of the master valve. There shall be a minimum of 18" and a maximum of 20" of cover for all lateral lines.

1001.5.5. PIPE AND FITTINGS:

1001.5.5.1 Installation of plastic pipe and fittings shall be in accordance with the manufacturer's published recommendations and procedures and as specified herein. Manufacturer's published recommended procedures for making solvent weld fittings shall be strictly adhered to.

1001.5.5.2 Caution shall be exercised by the CONTRACTOR in handling, loading, unloading and storing of PVC pipe and fittings. All PVC pipe shall be stored and transported in a vehicle with a bed long enough to allow the pipe to lie flat without subjecting it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged or in any other way found to be defective, either before, or after laying shall be replaced with sound pipe without additional expense to the OWNER.

1001.5.5.3 Before installation, the inside of the pipe shall be cleaned of all direct and foreign matter and shall be kept in cleaned condition during and after laying of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substances will enter the pipe or fittings. Where pipe ends are left for future expansion or connections, they shall be valved and capped, as directed on the plans and or by the ENGINEER.

1001.5.5.4 All PVC pipe and fittings shall be assembled to permit the pipe or fittings to be joined at the true parallel position of the fitting. Placement of pipe in curving trenches which causes bending and stress on pipe and fittings will not be permitted. No excess piping or fittings shall be permitted in the installation of the system, which may increase pressure loss or potential blockage.

1001.5.5.5 Excavation and trenching shall be true to line and depth specified in these specifications or indicated on the plans. Before installing the pipe, all rubbish and rocks shall be removed from the trenches. If the soil is extremely rock, the trenches shall be padded with dirt or sand as outlined in these specifications. Material used for pipe padding shall be approved by the ENGINEER. The full length of each section of the pipe shall rest solidly upon the bottom of the trench or bedding material.

1001.5.5.6 Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work. Any water which may be encountered or may accumulate in the trenches or excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the trench or excavation free and clear of water during the progress of the work.

1001.5.5.7 PVC pipe will expand or contract at the rate of 1 (one) inch per 100 feet per 10 degrees F change in temperature. Therefore, the pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

1001.5.5.8 Unless otherwise specified on the plans, all piping passing under sidewalks, roadways, parking lots, etc., shall be sleeved in a Class 200 PVC pipe two sizes larger than the pipe to be sleeved.

1001.5.5.9 When more than one pipe is installed in the same trench, in no case shall one pipe be installed above or below

another. Pipe can be installed in the same trench if pipes are laid side by side. In no case shall mainline and lateral pipe be installed in the same trench.

1001.5.5.10 The minimum horizontal clearance between lines in the same trench shall be 4 (four) inches.

1001.5.5.11 After all sprinkler piping, risers, valves, thrust blocks, etc., have been installed and partial backfilled as specified herein, the control valve shall be opened and a full head of water used to flush out the system. After the system is thoroughly flushed, risers shall be capped off and the system pressure tested in accordance with the testing section. At the conclusion of the pressure test the heads shall be installed and the backfill operation completed.

1001.5.6 SOLVENT WELDING PROCEDURE:

1001.5.6.1 PVC plastic pipe shall be squarely cut.

1001.5.6.2 Burrs left from cutting shall be wiped off with a clean, dry cloth.

1001.5.6.3 Utilizing a cleaner/primer, thoroughly clean the mating pipe end and the fitting socket with a clean dry cloth.

1001.5.6.4 Apply a uniform coat of solvent cement to the outside of the pipe end with a non-synthetic brush or dauber.

1001.5.6.5 In like manner, apply a thin coating of solvent cement to the inside of the fitting socket.

1001.5.6.6 Re-apply a light coat of solvent cement to the pipe and quickly insert it into the fitting to the full depth of the fitting socket.

1001.5.6.7 Rotate the pipe or fitting approximately 1/4 turn to insure even distribution of the solvent cement.

1001.5.6.8 Hold in position for approximately 30 seconds.

1001.5.6.9 Wipe off any excess solvent cement that forms as a bead around the outer shoulder.

1001.5.6.10 Care should be taken so as not to use an excess amount of solvent cement that could cause burrs or obstructions to form on the inside of the pipe joint.

1001.5.6.11 Solvent weld joints shall be allowed to cure for at least 24 hours before pressure is applied to the system.

1001.5.7 BACKFILLING:

1001.5.7.1 Upon completion of a particular section of the irrigation system, and after sufficient time has elapsed for the curing of solvent weld joints, partial backfilling can begin, leaving all joints, risers and connections exposed for visual inspection during the hydrostatic test. After completion and acceptance of the hydrostatic test by the ENGINEER for a particular section of the irrigation system the backfill operation can be completed.

1001.5.7.2 All backfill material shall be subject to approval by the ENGINEER. Backfill materials shall be free from rubbish, rock, large stones, brush, sod, frozen material or other unsuitable substances that may damage pipe during the backfilling operations.

1001.5.7.3 In the event that the material from the excavation or trenching is found to be unsuitable for use in backfill, it shall be removed from the site and properly disposed of by the CONTRACTOR and at his own expense. The CONTRACTOR shall then, at no additional cost to the OWNER, arrange for, purchase and/or furnish suitable backfill material consisting of earth, loam, sandy clay, sand, or other approved materials free of large clods of earth or sharp stones, approved by the ENGINEER.

1001.5.7.4 In rocky areas, the trench depth shall be 6 (six) inches below the normal trench depth to allow for 6 (six) inches of suitable backfill as padding for the pipe. In like manner, there shall be at least 6 (six) inches of padding on either side of the pipe as a padding against the rock wall of the trench.

1001.5.7.5 Backfill shall be placed in horizontal layers not exceeding 6 (six) inches in depth and shall be thoroughly tampered, rolled or otherwise compacted to original density or better so that no settling will result. Backfill shall be placed to the original ground level or to the limits designated on the plans. If settlement of trenches occurs within one year from date of completion, it shall be the CONTRACTOR'S responsibility to refill trenches and re-seed or sod the repaired areas.

1001.5.8 SADDLE TAPS: No saddle taps shall be permitted.

1001.5.9 SLEEVED CROSSING:

1001.5.9.1 Unless otherwise noted on plans, all piping installed under sidewalks, roadways, parking lots, etc., shall be sleeved in a Class 200 PVC pipe two sizes larger than the pipe to be sleeved. Wiring shall be placed in a separate sleeve from that of the pipe crossing and shall be 1 1/4 or larger Class 200.

1001.5.9.2 Every effort shall be made by the CONTRACTOR to install sleeving prior to the pouring or construction of the sidewalks, roadways, parking lots, etc., if at all possible. If prior sleeving is not possible, all crossings must be bored

unless authorization for an open cut is obtained from the ENGINEER.

1001.5.9.3 Sleeving ends, with the inner pipe or wire installed, shall be taped closed using a good quality duct tape to prevent the entrance of dirt into the sleeve.

1001.5.9.4 Arroyo crossings, if necessary, shall be sleeved in a Class 200 PVC pipe two sizes larger than the pipe to be sleeved and shall be installed a minimum of 36 inches below the flow line of the arroyo.

1001.5.10 THRUST BLOCKS: Concrete thrust blocks shall be provided where necessary to resist system pressure. Thrust blocks shall be constructed at all direction changes, size changes, valves and terminations, or at any other points of the system that will result in an unbalanced thrust line for equipment 2 (two) inches and larger. Do not obstruct the outlets of fittings which are intended for future connections. Thrush blocks shall be poured against undisturbed earth and in accordance with the plans or standard details.

1001.5.11 SPRINKLER HEADS:

1001.5.11.1 Sprinkler heads shall be the type and make specified and shall be installed to grade unless otherwise specified. Sprinkler heads shall be installed a maximum of 2 (two) inches from curbs, walls, driveways, building walls, etc.. Heads shall be installed in the vertical positions, hand backfilled and compacted to original density or better.

1001.5.11.2 Sprinkler head spacing shall not exceed the spacing shown on the plans and shall be in the approximate locations and configuration as shown on the plans. CONTRACTOR shall verify area dimensions while staking sprinkler head location. Sprinkler heads shall be spaced so that they are equidistant from one another for the given lengths and widths of the area to achieve uniform coverage.

1001.5.11.3 After all piping and risers are in place and connected and before installation of the sprinkler heads, all control valves for a given section shall be fully opened and a full head of water shall be used to flush out the system.

1001.5.11.4 If water pressure without the heads installed is not sufficient to provide adequate water flow from end risers, the CONTRACTOR shall cap off enough heads closest to the water source to provide adequate flushing of the end riser assemblies.

1001.12 CONTROLLER:

1001.12.1 The Controller location is indicated on the plans. The CONTRACTOR shall familiarize himself with the requirements of making the power connections at the locations noted (120 volt supply to the controller) and shall include the cost to complete this portion of the contract.

1001.5.12.2 The controller shall be mounted and wired according to the manufacturer's recommended procedures and as specified in these specifications and on the plans.

1001.5.12.3 Electric control valves shall be connected to controller in the numerical sequences as shown on the plans.

1001.5.12.4 Controller shall be installed in a locking controller enclosure as specified on the plans.

1001.5.13 ELECTRIC CONTROL VALVES:

1001.5.13.1 All electric control valves shall be of the type and size as indicated on the plans and shall be installed where shown on the plans, following the published recommendations of the manufacturer and in accordance with these specifications and plans.

1001.5.13.2 The valve boxes shall be locking and of the size and type as shown on the plans. Valve boxes shall be installed as shown on the plans.

1001.5.13.3 Valve wire splices shall be waterproofed using 3M Scotchlok Connectors or approved equal and the CONTRACTOR shall leave 24 (twenty-four) inches of coiled slack to facilitate raising splices to ground level without cutting wires.

1001.5.14 24 VOLT CONTROL VALVE WIRING:

1001.5.14.1 All wire installation procedures as described herein shall be checked to conform to local electrical codes.

1001.5.14.2 All wire used for the 24 volt wiring from the controller to the electric control valves shall be type "UF", 600 volt, solid copper, single conductor, PVC insulated and bear UL approval for direct burial underground feeder cable. Unless otherwise specified on the plans, the 24 volt common wires shall be wire No. 12 A.W.G. and the remaining 24 volt control wires shall be No. 12 A.W.G., and of colors other than white. These colors shall be noted on the "as-built" record drawings.

1001.5.14.3 Whenever possible, the CONTRACTOR shall install the 24 volt control valve wiring in the same trench as the sprinkler system mainline piping. All wires shall be laid on the bottom on one side of the pipe only and 2 (two) inches below the pipe. The wires shall be laid loose in the trench to allow for contraction of the wire. Control wires shall be taped together in 10'0" increments. When trenches used for piping

are not appropriate for routing of wire, a trench, 18" deep, shall be provided by the CONTRACTOR for 24 volt wires and shall be identified with dimensions on the "as-built" record drawings.

1002.5.14.4 Wire splices, other than at valve box locations, shall be kept to a minimum and if needed shall be made only at common splice points and placed in a wire splice box as shown on the plans or as approved by the ENGINEER. The location of these wire splice boxes shall be shown on the "as-built" record drawings. There shall be a 24" coil in the wires placed in the wire splice boxes so that the splices can be pulled out above ground level to facilitate testing and trouble shooting. No buried wire splices shall be permitted. All wire splices shall be made waterproof using 3M Scotchlok Connectors or approved equal.

1001.5.14.5 In no case shall wires of different colors be spliced together.

1001.5.14.6 Control wires shall be identified with E-Z Coder WDR Series Tape at each valve and at the Controller and at splices. Valves shall be numbered on the "as-built" record drawings.

1001.5.15 120 VOLT CONTROLLER POWER WIRING:

1001.5.15.1 The CONTRACTOR shall familiarize himself with the work required to complete this portion of the installation. All 120 volt wiring shall be installed in accordance with local electrical codes. The 120 volt service shall consist of one black and one white wire. The neutral wire must be bonded.

1001.5.15.2 120 volt power shall be supplied to the controller location by a licensed electrician.

1001.5.16 MANUAL DRAIN VALVE-MAINLINE:

1001.5.16.1 Manual drain valves of the size and type indicated on the plans shall be installed at all low points of mainline piping, or at any other points that may be indicated on the irrigation system plans or as specified herein.

1001.5.17 TESTING:

1001.5.17.1 Upon completion of the irrigation system's mainline, the entire mainline shall be tested for a 4 (four) hour period at 150 psi. Prior to testing the mainline shall be partially backfilled leaving all joints and connections exposed for visual inspection. All dirt shall be flushed from the system and the line filled with water to remove air. The mainline shall be brought to static pressure. A pressure gauge and temporary valve shall be installed at the end of the mainline to permit hydrostatic pressure to be applied to the main. A pressure of 150 psi must be retained for a 4 (four) hour period. Any leaks resulting in the 4 (four) hour pressure test shall be repaired and the system retested until the system passes the test.

1001.5.17.2 Upon completion of the irrigation system's lateral sections and after sufficient time has been allowed for solvent weld joints to cure, the entire system shall be hydrostatically tested by capping off all sprinkler head risers. On systems using flex nipples, or swing joints, the lateral line shall be tested prior to installation of the flex nipples or swing joints. Prior to capping, all air and dirt shall be flushed from the system and the pipe partially backfilled by center loading, leaving all joints, risers, swing joints and connections exposed for visual inspection. All lateral irrigation piping must be pressure tested for 1 (one) hour at 100 psi. The procedure shall be the same as used for the mainline. If after one hour no visible leakage has occurred and the 100 psi pressure has been retained, the heads shall be installed, and the backfill operation completed. Any leaks resulting from the hydrostatic test shall be repaired and the system retested until the system passes the test.

1001.5.18 ADJUSTING OF SYSTEM:

Upon completion of the installation, the CONTRACTOR shall adjust all heads and valves and program controller to provide optimum sprinkler system performance. It will be the OWNER'S responsibility to make any minor adjustments to the system during the guarantee period.

1001.5.19 CLEAN UP: The CONTRACTOR shall continuously keep a neat and orderly area in which he is installing the system. Disposal of rubbish and waste material resulting from the installation shall be continual. Upon completion of the system, the CONTRACTOR shall remove from the OWNER'S property at his own expense, all temporary structures, rubbish, waste material, tools, and equipment resulting from or used in the installation of the system.

1001.5.20 PROTECTION OF EXISTING UTILITIES: The CONTRACTOR shall be responsible for locating all cables, conduits, piping, and any other utilities or structures that may be encountered either above or below ground. All necessary precautions must be taken by the CONTRACTOR to prevent any damage to these existing improvements. In the event that such damage should occur from his operations, the CONTRACTOR shall repair or replace or bring to original condition the damaged utilities or improvements at his own expense.

1001.5.21 ROCK: If the CONTRACTOR encounters rock or other unfavorable trenching conditions, no additional compensation will be paid. When material

from the excavation or trenching is unsuitable for use as backfill, additional backfill material suitable for this purpose and approved by the ENGINEER, shall be brought in at the expense of the CONTRACTOR. It shall also be the CONTRACTOR'S responsibility to remove and dispose of all unsuitable materials removed from the trench that cannot be used in the backfill operation.

1001.5.22 FINAL ACCEPTANCE:

1001.5.22.1 When the CONTRACTOR is satisfied that the system is operating properly, that it is balanced and adjusted, that all work and cleanup is completed, he shall request an inspection of the irrigation system by the ENGINEER and OWNER. At that time, the CONTRACTOR shall demonstrate each system in its entirety. In inspecting the work, no allowance for deviation from the original plans and specifications will be made unless prior approval has been obtained. This system review must be completed prior to beginning planting operations.

1001.5.22.2 Any inconsistencies to the specifications shall be noted by the ENGINEER and the OWNER and a written copy of corrections needed shall be given to the CONTRACTOR. Any work deemed not acceptable shall be reworked to the complete satisfaction of the OWNER and the ENGINEER at no additional cost to the OWNER.

1001.5.22.3 When all work is completed to the satisfaction of the OWNER, a written acceptance of the total project will be given to the CONTRACTOR upon furnishing, by the CONTRACTOR of a complete "as-built" record drawing of the irrigation system that is acceptable to the OWNER.

1001.5.23 OPERATIONAL INSTRUCTION: After the system has been tested and accepted, the CONTRACTOR, along with the ENGINEER shall instruct the OWNER in the operation and maintenance of the system.

1001.5.24 SYSTEM MAINTENANCE AND WARRANTY:

1001.5.24.1 For a period of one year from final acceptance of the system, the CONTRACTOR will promptly furnish and install, without cost to the OWNER, any and all parts or materials which prove defective in material or workmanship. All damage due to irrigation system line breaks caused by defective material or workmanship shall be repaired and brought to original condition by the CONTRACTOR at no expense to the OWNER. The CONTRACTOR shall complete all repairs within 24 hours of receipt of notification from the OWNER of system failure.

1001.5.24.2 Minor maintenance of the system shall be the responsibility of the OWNER.

1001.5.24.3 For a period of one year from final acceptance of the system, the CONTRACTOR shall repair any settlement of the trenches by one of the following methods as directed by the ENGINEER and the OWNER.

1001.5.24.3.1 Bring to grade by top dressing (raking top soil into the grass).

1001.5.24.3.2 Bring to grade with top soil and seed.

1001.5.24.3.3 Remove existing sod, fill depression with top soil, and replace with new sod to match existing sod.

1001.5.24.4 Repair by any of the above methods must result in a smooth, level area. Maintenance of repaired areas shall be the responsibility of the OWNER. Repair shall be completed by the CONTRACTOR within 48 hours after notification from the OWNER of trench settlement problems.

1001.6 INSPECTIONS

1001.6.1 The following inspections shall be the minimum required inspections during the course of construction. Additional inspections shall be made at any time at the discretion of the ENGINEER or OWNER. It shall be the responsibility of the CONTRACTOR to notify the ENGINEER in writing 48 hours in advance of each required inspection. The sequence of required inspection shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work in the next sequence without written approval of the previous sequence. Payment will not be approved for items which have not been inspected and approved in writing.

1001.6.1.1 Inspect staked locations of mainline, valves, laterals, and sprinkler heads.

1001.6.1.2 Inspect 24 volt control wire installation.

1001.6.1.3 Inspect and pressure test mainline and electric control valve installation.

1001.6.1.4 Inspect and pressure test lateral irrigation line installation.

1001.6.1.5 Inspect automatic controller installation and operation.

1001.6.1.6 Inspect sprinkler and bubbler head placement, coverage and operating pressure prior to planting.

1001.6.1.7 Final project inspection and acceptance.

1001.6.1.8 Inspect at end of the maintenance period.

1001.7. MEASUREMENT AND PAYMENT

1001.7.1 Measurement of the landscape irrigation system shall be lump sum or by units of the major components of the system as specified in the Supplemental Technical Specifications and/or the Bid Proposal and shall include the entire irrigation system from the water meter.

1001.7.2 Payment shall be at the contract price per lump sum or per unit as specified in the Supplemental Technical Specifications and in the Bid Proposal, which shall include all material, equipment and labor required to install and make operational the irrigation system.